rence Rotch proposed to undertake with kites on a contemplated trip across the Atlantic. We reprint herewith his account of the results of his experiments, which must be considered as in every way successful. Evidently we need to know more of the upper air conditions over the ocean. As has been shown on page 563 of this REVIEW the conditions on the Atlantic must have an important bearing on the movement of storms across our own country. We therefore heartily indorse any movement that will increase our knowledge of oceanic meteorology.

To the Editor of Science: On page 412 of Science I stated that meteorological observations were about to be attempted with kites flown from a transatlantic steamer. With the aid of my assistant, Mr. Sweetland, and through the courtesy of Captain McAuley, this was accomplished on board the Dominion steamship *Commonwealth*, which left Boston for Liverpool on August 28, 1901. During most of the voyage we were within an area of high barometric pressure that was drifting slowly southeastward and out of which light winds blew. Although these were insufficient to raise the kites, the ship's speed of 16 knots created a corresponding wind from an easterly direction that sufficed to lift the kites on five of the eight days occupied by the voyage to Queenstown. On one of the three unfavorable days, a following wind became too light on the ship for kite flying, and on the two other days a fresh head wind, augmented by the forward motion of the ship, was so strong as to endanger the kites, but had it been possible to alter the course of the vessel a favorable resultant wind might have been produced every day. The maximum height attained was only about 2,000 feet, but with larger kites and longer wire this could have been greatly exceeded. Automatic records were obtained of barometric pressure, air temperature, relative humidity, and wind velocity, which did not differ markedly from records obtained in somewhat analogous weather conditions over the land. The most striking feature was the rapid decrease of the temperature with increasing height in all but one of the flights. The *fall* of temperature was fastest in the first 300 feet, where it exceeded the adiabatic rate of 1° Fahrenheit in 183 feet, but in the last-mentioned flight the temperature *rose* 6° in 450 feet, and during the afternoon remained so much warmer than at sea level. The relative humidity varied inversely with the temperature; the direction of the wind shifted aloft toward the right hand, when facing it, and its velocity generally increased with altitude. These are probably the first meteorological observations at a considerable height in the mid-Atlantic, and have a special importance because they indicate that at sea high-level observations may be obtained with kites in all weather conditions, only excepting severe gales, provided the steamer from which the kites are flown can be so maneuvered as to bring the wind to a suitable velocity.

As the basis of an appeal for the exploration of the atmosphere at sea, the records described were exhibited to the geographical section of the British Association at its Glasgow meeting, and the appointment of a committee with a grant of money to undertake observations with kites in Great Britain, together with the interest manifested there and on the continent of Europe, encourages the hope that my project will be realized. The equipping of the English antarctic vessel *Discovery* with meteorological kites, as mentioned on page 779 of Science, and a similar installation on the German antarctic ship *Gauss*, are unlikely, for various reasons, to have yielded much data on their voyages across the Equator. Although the United States has taken no part in this international undertaking, an opportunity is now offered, without material expense, danger, or hardship to cooperate in a study of the general atmospheric circulation, which is one of the objects of polar exploration. Indeed, for a naval vessel not actually engaged otherwise, the sounding of the atmosphere in the Tropics, whereby the relation of the upper air currents to the winds useful for navigation may be ascertained, would seem to be as legitimate a task as sounding the depths of the oceans and determining the currents and temperatures prevailing there. But if our Navy Department will not authorize this, a private expedition should be organized to investigate the questions mentioned in my letter to Science on a new field for kites in meteorology. Since then Professor Hildebrandsson, of Upsala, who is an eminent authority on the circulation of the atmosphere, writes me that a meteorologist on a steamship provided with kites and also with small balloons to ascertain the drift of the upper winds when there are no clouds, by making atmospheric soundings between the area of high barometric pressure in the North Atlantic and the constant southeast trades south of the Equator, and in this way investigating the temperature and the flow of the so-called antitrades, could solve in three months one of the most important problem in meteorology. If any of your readers will furnish the steamer required, I stand ready to carry out these investigations.—*H. H. K.*

CLIMATE AND CROPS.

The United States Department of Agriculture is continually experimenting to ascertain by what means the farmer may increase the quantity and quality of his crops with the least expense to himself. New varieties of seed are introduced; plant diseases are studied, and remedies suggested; different kinds of fertilizers are analyzed, and likewise the soils from different localities; and the needs of the various soils for the crops to which they are adapted are pointed out.

The Division of Chemistry has for a long time been investigating the effect of climate upon crops, especially also as to its effect upon the quality of the crop. As an example of investigation along these lines, we may refer to the recent publication[1] by Dr. Harvey W. Wiley, Chief of the Bureau of Chemistry, On the Influence of Environment upon the Composition of the Sugar Beet.

In his letter of transmittal to the Secretary of Agriculture, Dr. Wiley refers to this work as

> Showing the results of the study of the Division of Chemistry, in collaboration with a number of the experiment stations and with the Weather Bureau, of effect of environment upon the chemical composition of the sugar beet.

The average meteorological conditions at selected stations were considered each month during the season of vegetation, as follows: Mean temperature; total precipitation; hours of sunshine; ratio of actual to possible sunshine, in percentages; number of clear days; number of cloudy days.

In his "Conclusions," Dr. Wiley shows that there is a close relation between latitude and percentage of sugar in the beet; this relation is probably due to the lower temperature in the higher latitudes.

The quality of the beet does not appear to depend upon the amount of direct sunlight it receives, the diffused light coming through the clouds evidently being quite as effective as the direct rays, but the average length of day from sunrise to sunset has a direct relation to the content of sugar in the beet, since the longer the day the higher the percentage of sugar.

The distribution of rainfall by months is also shown to have an important influence upon the sugar content, the best results being obtained with 3 to 4 inches of rainfall per month during May, June, July, and August, and a reduction of the rainfall during September and October.

The close relation between the meteorological conditions and the quality of the sugar beet is clearly set forth in the concluding paragraphs of Dr. Wiley's bulletin, as follows:

> The above conclusions, derived from these studies of a year, are quite in harmony with the theories which already prevail in regard to the effect of seasonal influences upon the sugar content of the beet. There are many problems, however, presented by the data, which offer an inviting field of study. Chief among these is the suggestion, which has already been made in a previous part of this bulletin, that the high temperature line which seems to be so disastrous in its effects upon the sugar content of the beet may not produce all these ill effects directly as the result of the high temperature, but indirectly in the effect produced upon the moisture in the soil, the arrest of growth by dry weather, the inducement of a second growth on the accession of rains following a drought, and in other indirect ways. The study of this problem would best be carried on in an irrigated arid region where the temperature is high during the growing months and where the distribution of water on an experimental plat could be absolutely controlled. Other new problems of interest are also presented in studying the effects of direct and indirect sunshine and the distribution of the hours of direct sunshine compared with indirect and with partly cloudy weather.
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> In the study of these problems so far we are indebted to the cordial cooperation of the Weather Bureau and experiment stations and in the further elaboration of them we rely on the promise of the continuance of this aid. It is certain that environment, of which meteorological conditions form the chief component, have a most marked influence on the chemical composition of crops, and without the assistance of the Weather Bureau it would be difficult to properly study the extent of the changes produced.

This bulletin indicates the relation between the meteoro-

[1] Bulletin No. 64, United States Department of Agriculture, Bureau of Chemistry, Washington, D. C., 1901.

logical conditions at selected stations and the quality of a single crop. It shows at once that in certain sections sugar beets can not be successfully raised, not because they will not grow, but because the percentage of sugar content is too small. It also shows that apparently high temperature is responsible for the inferior quality of the beet at southern experiment stations.

No doubt similar investigations would disclose equally interesting relations between meteorological conditions and other crops; and in these relations, not alone the farmer, but the whole country is deeply interested.

The investigation of the chemical composition of crops must of course be conducted by the Bureau of Chemistry, but the Weather Bureau, through its corps of more than 3,000 meteorological observers, is able to supply climatic data not otherwise available, and it takes pleasure in cooperating with other bureaus in the promotion of these important investigations.

The Climate and Crop Division of the Weather Bureau is conducting a most important investigation into the relations between the meteorological and the general crop conditions, especially the yield per acre. The crop bulletins, issued weekly during the season of vegetation, summarize for each State the general effect of the weather upon the crops. Any one who is interested in the subject can easily trace, week by week, the effect of abnormal heat, unseasonable cold, excessive rains, or drought upon the various crops. The Bureau of Chemistry is investigating questions that these reports can not touch upon, i. e., the relation between the chemical composition of the crops and these meteorological conditions.

These facts help to emphasize the intimate relations that exist between the work of the various scientific bureaus of the Department of Agriculture. In fact, just such amicable relations should exist between the work of the various scientific bureaus and societies of the whole country. Each can and must draw from and contribute to the work of others; for no science is complete in itself. From mutual cooperation will come mutual advancement.

The importance of the work of our voluntary observers is also clearly shown. The number of fully equipped stations with a paid corps of observers is necessarily limited. Furthermore, most of the first class stations must be located in large cities near the centers of population, where the meteorological conditions differ materially from those that prevail in the agricultural districts. Our voluntary observers are, as a rule, located in the midst of crop producing districts, and they are therefore able to supply just the data required for the study of the relation of the crop to the meteorological conditions. Too much emphasis can not be placed upon the importance of the data they are furnishing, and also upon the necessity for accuracy and faithfulness on the part of the observers who make and record the observations.—*H. H. K.*

THE METEOROLOGICAL SOCIETY OF MAURITIUS.

In a paper read before the Meteorological Society of Mauritius on April 11, 1901, Mr. T. F. Claxton, F. R. A. S., reviewed very briefly the results achieved during the fifty years of its existence. He stated that the society was established on the first day of August, 1851, its primary object being the promotion of meteorological science in general, and especially that branch of it called cyclonology or the laws of storms.

To this end the society undertook the following work:

1. To procure instruments of the best description as standards of comparison, and to endeavor to keep a supply of other instruments at moderate prices for the use of persons in the colony and its dependencies, and of commanders and masters of vessels.
2. To provide for meteorological, magnetical, and tidal observations being made in Mauritius and its dependencies, Rodrigues, Seychelles, Diego Garcia, etc., and to aim at the establishment of a permanent meteorological and magnetical observatory.
3. To tabulate meteorological observations taken daily on board vessels in the Indian Ocean.
4. To collect or procure extracts from any meteorological records existing in the archives of the colony, or in hands of private individuals.
5. To encourage masters of vessels trading to this island to make and record observations on the state of the weather, tides, and currents as experienced in the course of their respective voyages, and to communicate such observations to the society.
6. To correspond and exchange observations with similar societies in other countries.
7. To collate, arrange, and publish the information that may be obtained from the above sources.

Probably the most important work of the society has been in connection with the establishment and maintenance of the Royal Alfred Observatory at Mauritius, the comparison of ships' barometers and chronometers with the standards of this observatory, and the collection and discussion of meteorological data from the log books of vessels and from other sources. Barometer comparisons are effected by means of one or two readings of the ship's barometer that are made by a clerk from the observatory. It would seem that much better comparisons would be obtained if the ship's captain were induced to make daily readings while in port, as is done by our own Hydrographic Office. Not only would a greater number of readings be obtained for comparison, but the personal error of the captain's readings and the chance of introducing new errors would also be eliminated.

The decreased number of vessels now stopping at Mauritius as compared with former years, and also the change from the slow sailing to the faster steam vessels, has seriously diminished the number of observations that can be obtained from ships' log books. To offset this loss special efforts are now being made to establish permanent stations on the various small islands in the Indian Ocean.

It is to be hoped that this may be accomplished, since it will be a source of regret to meteorologists if the valuable studies of cyclones in the Indian Ocean, which have been conducted by the society in years past, should now be curtailed through lack of meteorological data.

Mr. Claxton refers with justifiable pride to the publications of the society. Among these he makes special mention of the daily synoptic weather charts of the Indian Ocean. These commenced with January, 1861, and were published under the direction of Dr. C. Meldrum in 1881. Of late years, owing to the few reports received from vessels, the charts have been published during the hurricane season only.

The Cyclone Tracks published in 1891 is another valuable work, and especially the annual reports of the Royal Alfred Observatory which go far toward filling what would otherwise be a large gap in our meteorological observations in the southern hemisphere. A meteorological atlas of the south Indian Ocean is in preparation.

We heartily congratulate the Meteorological Society of Mauritius upon the results achieved during its half century of work. The members are imbued with the true spirit of investigation, and we look for even better results in the future.

Can not nephoscope observations be made and discussed at the Royal Alfred Observatory?—*H. H. K.*

EARLY METEOROLOGICAL RECORDS.

In the Climate and Crop Report for November, Dr. O. L. Fassig has begun the reprint of some notes by Rev. John Campanius on the weather near Wilmington, Del., during 1644 and 1645. We can but believe that similar ancient records for other parts of the country can be discovered by diligent research. For instance, it was quite the custom for southern planters to keep a daily record of the weather in